10TH INTERNATIONAL COMMAND AND CONTROL RESEARCH AND TECHNOLOGY SYMPOSIUM: THE FUTURE OF C2

Title: Power to the Edge…Sometimes
Edge Organizations

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Abstract

"Power to the Edge…Sometimes" evolves the criteria used to set the locus of command. The next logical step in command theory turns on several key considerations. First, traditional models place the locus of command statically. This leaves an organization susceptible to risks and emerging challanges it was not designed to meet. Second, a clear distinction exists between an information rich environment and an understanding rich environment. Those in an information-rich environment may be able to "see" the situation but will not always be able to understand the situation. Third, game theory strongly suggests that when resources are limited, individuals will compete for them at the expense of self-synchronization and working toward a global maximum. Understanding imparts no motive to achieve a global maximization. The conclusion: the correct model for placing the locus of command should no longer set command statically within the organization. Command should be allocated dynamically to wherever the understanding of information along with the motivation to achieve a global maximization of desired effects is present–this is agile command and control.

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
JUN 2005		**00-00-2005 to 00-00-2005**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Power to the Edge...Sometimes Edge Organizations	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Air Force Research Laboratory,Information Directorate ,525 Brooks road,Rome,NY,13441**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES
2005 International Command and Control Research Technology Symposium

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT **unclassified**	b. ABSTRACT **unclassified**	c. THIS PAGE **unclassified**		**10**	

Introduction

Power to the Edge has become something of a catch-phrase over the course of the past two years. The ideas contained in David Alberts and Richard Hayes' book *Power to the Edge: Command and Control in the Information Age* have had influence well beyond halls beyond where they were penned.[1] The phrase itself and the text it represents embody a new way of thinking about warfare and in turn, command and control. A recent GAO report to congressional committees endorses the doctrine stating:

> While senior leaders are becoming increasingly involved in operations, information is also being distributed to lower and lower organizational levels, raising the potential for increased autonomy for small units and individual soldiers. For example, one of the principal organizing and operating tenets of network-centric operations is the concept called power to the edge. This concept involves empowering individuals at the "edge" of an organization—where it interacts with its operating environment—by expanding access to information and eliminating unnecessary constraints on action. [2]

The report goes on to say that, "According to officials at the Joint Forces Command, this concept helped DOD use smaller formations of personnel with flexible command and control relationships to great advantage during operations in Iraq."[3] The initial drafts of any revolutionary proposals are susceptible to overstatement and premature acceptance. There is a Hebrew proverb that reads, "The first to present his case seems right, till another comes forward and questions him."

The goal of this paper is to evolve the criteria used to set the locus of command. The next logical step in command theory turns on several key points of critique. First, traditional models place the locus of command statically leaving an organization susceptible to risks it was not designed to meet. Second, a clear distinction exists between an information rich environment and an understanding rich environment. Those in an information-rich environment may be able to "see" the situation but will not always be able to understand the situation. Third, game theory strongly suggests that when resources are limited, individuals will compete for them at the expense of self-synchronization and working toward a global maximum. Although a deep understanding of the situation may exist among commanders, this does not entail a concomitant motivation to achieve common goals and to globally maximize the allocation of scarce resources. I will argue that the correct model for placing the locus of command should no longer set command statically within the organization. Command should be allocated dynamically to wherever the understanding of information along with the motivation to achieve a global maximization of desired effects is present. This is a model for agile command and control.

Alberts and Hayes advocate and further develop the present thrust of command and control theory. *Power to the Edge* does an good job pulling together and encapsulating thoughts that have been around for a number of years. The book marries the two logically distinct

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[1] David S. Alberts and Richard E. Hays, *Power to the Edge: Command Control in the Information Age* (CCRP: June 2003).
[2] GAO 04-547, "Military Operations: Recent Campaigns Benefited from Improved Communications and Technology, but Barriers to Continued Progress Remain," *GAO Report to Congressional Committees* (June 2004).
[3] Ibid.

concepts of the Auftragstaktik command philosophy and Net-Centric warfare.[4] The authors present this union to us as Power to the Edge. I will give a synopsis of the evolution of command and control theory in recent history, and offer a view that moves us beyond what has been articulated in *Power to the Edge*.

Background

I first want to fix some working definitions of command and of control. In their article "Re-Conceptualizing Command and Control," Ross Pigeau and Carol McCann assert that command is the creative expression of human will necessary to accomplish the mission."[5] What I like is that Pigeau and McCann stress the humanness involved in command. Command sciences will emphasize the human elements.[6] This emphasis is lost in many approaches to command and control. The most important piece on the board of command and control will always be the human. Instead of adopting their definition without qualification, I will add one note. What we are willing to call command is tied up in our definition of command. So if our definition of command contains the idea that only humans command, no computer will ever command any vehicles, resources, or make any *command* decisions. In 1950 Turing proposed we consider the question, 'Can machines think?' He posed the 'imitation game' as a test—a measure of our ability to develop a machine that could perform at a level, under certain circumstances, that we could not discern from that of a man. I believe that in certain circumstances, this does occur. There are times when machines do seem to meet the definition of command. Pigeau and McCann go on in their article to note that command is a function of competency, responsibility, and authority (or CAR). Command is defined in terms of these functions, and these functions reflect the importance of the human component. When one has command, CAR should be balanced. Without this balance, commanders will not produce the desired effects. Command is the expression of a competency, responsibility, and authority. Effective command is a balance between competency, responsibility, and authority.[7] With this definition, we can see that there can be few or many that command.

Models for Command

The traditional model of command is centralized command. Proponents of centralized command believe that competency, responsibility, and authority converge on a small group, and often a single person. These proponents gave us model one:

1) The locus of command should be centralized

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[4] A fully networked force does not necessarily entail decentralized C2 and decentralized C2 does not necessarily entail a networked force.

[5] Ross Pigeau and Carol McCann, "Re-conceptualizing Command and Control," *Canadian Military Journal*, Spring 2002, 53-63.

[6] Ross Pigeau and Carol McCann, *The Human in Command*, eds. (New York: Kluwer Academic, 2000). Part II of this treatise brings together 15 articles stressing the centrality of the human in every aspect of command and control.

[7] In "Re-conceptualizing," Pigeau and McCann argue that when any one of these is out of balance, the effects are normally lacking.

The traditional school has equated "Unity of Command" with operating under a single commander who has requisite authority to direct all forces toward a common purpose.[8] This model has its strengths. The direction of the effort, the speed at which the effort is executed, and control of potentially negative actions are bound in a small and competent group. The commander has immediate and direct influence into decisions that could change the scope or dynamic of the effort at hand. In this model, the commander and his immediate staff work to coordinate personnel, material, and financial resources geographically and temporally. The commander communicates his or her will to the troops executing a carefully sculpted plan.

In recent times the academy (the group that prolifically writes and publishes on C2 issues) has found fault with model 1. I will quote a paragraph from Alberts and Hayes as an example:

> For centralized planning to work, it must be possible for a relatively small group of people to do all of the following: make sense of the situation, maintain this understanding in the face of a dynamic environment, predict the future, develop an appropriate response strategy, decompose the response into a coherent set of executable tasks, allocate resources, task subordinates, monitor execution, and make adjustments as required, all in a timely manner…Ironically, centralized planning processes are designed to deconflict tasks and elements of the force so that they will not get in each other's way or do harm to one another. They prize deconfliction over synergy. This prevents simultaneity and synergies necessary to perform anywhere near optimality. Centralized planning is antithetical to optimality because it (1) is relatively slow to recognize and respond to changes in the situation, (2) results in ill-informed participants and (3) places many constraints on behavior...[On this model industrial age organizations] do not effectively take advantage of information and expertise available. An organization that does not promote the widespread sharing of information will not have well informed individuals and organizational entities.[9]

Though there are some questionable premises within these statements that will be returned to, what is clear is that model 1 inadequately utilize decision quality information available at the "edge" of the organization. If that information is acted upon, it has the potential to make an event transpire nearer to optimality. Lower level empowerment may better optimize the use of personnel, material, or financial resources. With model 1, since members at the lower levels of an organization must coordinate all decision through the centralized locus of command, many windows of optimality are closed before action can be taken. The information that could have been acted upon if some other model of command were in place was fleeting and soon passed away.

Model 1 has lost many supporters to a different model:

2) The locus of command should be decentralized

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[8] *Joint Publication 3-0: Doctrine for Joint Operations* (10 Sept 2001), A-2.
[9] *Power to the Edge, 63-64.*

America started paying closer attention to a decentralized command structure after identifying the efficiency of the German Wehrmacht in the years after World War II.[10] Even as late as 1990 decentralized command concepts were not spreading to the entire military. Michael Harwood writes bleakly at that date, "To date, A there is little evidence to suggest that 'power down' exists outside the confines of Fort Hood."[11] Since he wrote that piece, the revolution in military affairs began to take hold. The publication of the monumental text *Net Centric Warfare* marked a turn in command philosophy in the United States. The ideas contained in the work resonated with decision makers across the military and, in turn, challenged C2 theoreticians to accommodate NCW concepts.

After rejuvenating the philosophy, the theoreticians promptly presented Auftragstaktik in the new packaging of mission or directive command. And now it is also inextricable from "power to the edge." According to Alberts and Hayes, "Power to the edge can increase the power of an organization by (1) increasing power of edge entities and (2) increasing the percentage of edge entities."[12] This is the move to decentralize command and bring the locus to the edge. Today, when decentralized command is spoken of, it is loaded with the content of power to the edge concepts. Today then, decentralized command rests principally on three tenets. First, net-centric operations provide an information-rich environment to those on the edge of an organization. Second, as these information satiated individuals emerge, they should pull power away from the center and empower the edge.[13] Third, individuals who have access to the network and its information will be able to synchronize without a centralized commander to coordinate their efforts. Power to the edge stands or falls on the premises of edge information, information empowerment, and self-synchronization.[14]

The strength of this model is its promise of flexibility and agility enabled by empowered individuals making the right decisions at the right time with the right information. Since its entrance into limelight, some have begun to question the foundational assumptions. Model 2, which puts forward a decentralized locus of command, will work only insofar as all information is at the edge of the organization. Not even the most ambitious pictures of net-centric warfare make this claim. Information can come from the center or come from the edge. As long as humans are in the loop, not all information will ever permeate the edge of an organization. Robert R. Leonhard casts doubts on the first assumption—that information can always be on the edge. He contends that model 1 is a static model that limits flexibility by assuming that the information that will yield optimality will always be found at the edge. Since decision quality information is not always located at the edge, model 2 falls. There will always be situations in

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[10] See Joint Pub 3-56 (dated); FM 100-5 (1982, 1986, 1993); TRADOC Pamphlet 525-5 (1994); TRADOC Pamphlet 525-66 (2003).

[11] Michael J. Harwood, *Auftragstaktik: We Can't Get There From Here* (School of Advanced Military Studies, 1990), 35.

[12] *PTTE*, 172.

[13] Ibid., 184.

[14] Others have noted what else is needed to get to decentralized command. Keithly and Ferris add that subordinate commanders must have leeway to take initiative, and there must be an acceptance of prudent risk taking and not a "zero defects" mindset. The commander's intent and his desired end-state must also be made known to the entire force and there must be mutual trust between superior and subordinate decision makers. Finally execution must be decentralized. David M. Keithly and Stephen P. Ferris, "Auftragstaktik, or Directive Control, in Joint and Combined Operations," *Parameters* (Autumn 1999), 118-133.

which pieces of information will not be on the edge.[15] Leonhard envisions a dynamic locus of command that follows information wherever it might be. This leads to model 3:

3) The locus of command should follow information

Leonhard writes, "The movement of battlefield information should determine who makes what decisions...When the tempo of information flow gives subordinates a more accurate and timely view of the battlefield, then they should have decision-making authority that is commensurate with information…*Authority must follow information.*"[16] So then, proponents of Auftragstaktik, or whatever name one wants to call it, have mistakenly attributed the successes of the Wehrmacht to a timeless truth that decentralized command always produces better results. The success of the Wehrmacht worked when it worked because it adjusted authority to bring it in line with the state of information flow. Leonhard states, "When, on the other hand, the higher headquarters has the information faster, decision making authority should be centralized."[17]

Model 3 accommodates the timeliness response to information. It leaves open the question of the location of information so it does not pin the locus of command to the edge. Not all information will be on the net all the time.

Richard Chilcoat has made a very insightful observation that question the reasoning leading from premise one to premise two. These observations serve to evolve the debate on the locus of command. He says:

> Some analysts of the Force XXI battlefield reason that since the lower-echelon commander will possess so much greater situational awareness, he should be empowered with far greater latitude and independence...But one can easily argue the other way…On the digitalized battlefield, however, the lower-echelon commander's situational awareness will no longer be unique…The most likely outcome is that the degree of control will vary according to the circumstances."[18]

We can derive much from these words but for lack of time will limit ourselves to some brief observations. If a person's decision making information comes through electronic mediums, then the decision being made is not tied to a geographical place. To put it another way, if the information gained from the network is what is doing the empowering, then it is not the decentralization of personnel or their nearness and their proximity to the event that empowers the person nearest to the event at hand.[19] The information on the net pushes equally toward

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[15] This is most evident when speaking about commander's intent—or the decentralized equivalent of commanders' intent (since in its purest form decentralized command would have to commander's intent). How a commander would react in a particular situation would certainly be a valuable piece of information to have. Once this piece of information is present, we no longer have decentralized command.

[16] Robert R. Leonhard, *The Principles of War for the Information Age* (Novato California: Pesidio Press, 1998), 201. Italics his.

[17] Ibid.

[18] Richard A. Chilcoat, "The 'Fourth' Army War College: Preparing Strategic Leaders for the Next Century," *Parameters* (Winter 1995-96, 3-17).

[19] If a person's situational awareness comes exclusively through electronic mediums (the network, sensing devices, etc.), it is at this point that perhaps having a human on-scene—as opposed to remotely operating an autonomous robot is not necessary and perhaps not beneficial. This also may serve as a principle for deciding when a machine should be pursued to execute a human's job. My friend Mike Wessing pointed this principle out to me.

centralized command with decentralized execution as it does to decentralized command. This observation undercuts the logic used to reach the second tenet of Power to the Edge.

Model 3 takes us beyond the models of having a static locus of command. It is strong because it can accommodate information derived from places other than the net. The ideal model will be one that allows for transitions of authority that accommodate various sources of information.[20]

Model 3 is not free of concerns. Nineteenth century philosophy definitively pushed mankind over a hump that claimed men's minds were passively involved in the sense-making process. It was Immanuel Kant who successfully argued that men actively synthesize the information they receive. Without the *cogito*, synthesis does not take place and information is never understood or processed by the mind. Models 2 and 3 make a faulty assumption about information. Each supposes that information equals understanding. Some have tried to anticipate this by saying that information handling decision makers must have training.[21] Jim Storr writes, "There is no point in giving subordinates freedom of operation when they simply don't know what to do."[22] I don't think Storr has fully confronted my concern. Training, or even time spent together, may enable a group to synchronized better. Yet having a synchronized team doesn't entail having a team that understands how to best act in a given situation. Training then is crucial, but solving the model's problems by training still uses a model of a passive human mind that passively assimilates observations and assumes that one understands what is before it. Training does not entail understanding. John Nash, who the movie "A Beautiful Mind" was based upon, was known for not having gone to more than a handful of classes over the course of his graduate studies. Nonetheless, Nash was known to have an understanding of countless aspects of economics and math that went well beyond his classroom colleagues' understanding. In addition, we can note that scholastic abilities or even numerous rehearsals are not a replacement for field experience.

When young chicks are hatched, the males are placed on a different program from the females for many different reasons. Yet 99.99% of people cannot tell the difference between a male and a female. In fact, those that can tell the difference cannot effectively communicate or point out that difference to the large majority so that they can see the difference! When someone with understanding looks at the same situation and sees the same information as everyone else, he is able to "see" a lot more—some of it cannot be readily described or discerned by even that person with understanding. This intuition does not come solely from training.[23] Leaders often raise to the top because they have better intuitions than the rest of us and can even understand much more with *much less* information. If not everyone that graduates training turns out to be a commander, asserting that command should follow training does not capture a more basic element. The point here is that training and information do not equate to knowledge and competency. Competency, from our definition of command, entails this very human element—understanding. Alfred Kaufman hits the mark when he writes, "Shared information does not automatically, if ever, lead to shared understanding."[24] Model 4 evolves beyond this:

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[20] Robert R. Leonhard, "The Death of Mission Tactics," *Army* (July 1994), 18.

[21] Jim Storr, "A Command Philosophy for the Information Age: the Continuing Relevance of Mission Command," *The Big Issue: Command and Combat in the Information Age*, The Occasional No. 45, Ed. David Potts (CCRP: July 2004), 91.

[22] Ibid.

[23] See also G. Klein, *Sources of Power: How People Make Decisions* (Cambridge: MIT Press, 1998).

[24] Alfred Kaufman, "Caught in the Network: How the Doctrine of Net-Centric Warfare Allows Technology to Dictate Military Strategy," *Armed Forces Journal*, February 2005 (Defense News Media Group), 20f.

4) The locus of command should follow understanding

This formulation leaves open the number of entities that are empowered. There will be times when a supreme commander has the most understanding of a situation. There will be times when an individual on the edge has understanding. With perfect understanding, an empowered individual could engage a time critical target of opportunity with no coordination and change the phased execution of the pre-planned strategy and better optimize the conflicts outcome. One difficulty with this model is knowing who has the most understanding at any given time since we have made a divide between information and understanding. How does one know she has decision quality understanding? This is a pragmatic question.[25] Only in a perfect world, if there was an individual who understood how perfectly to resolve a situation would that person have the authority and power to do so.

Of course we don't live in that world. But we do live in a world where the landscape of warfare has dramatically changed. This landscape demands repeated quick and seamless handoffs of command to optimally meet an impending threat. These features make model 4 strong. Command is not pinned to a particular place in the organization. But since this model will likely be modified by the advocates of decentralized C2 so that the take-away is: we need to make sure that decentralized commanders have information *and* understanding, I want to stress another reason why understanding is often at odds with a blanket promotion of decentralized command.

Martin Van Creveld concludes *Command in War* by saying that decentralized command "will probably remain superior to [the other options] in virtually every case."[26] He subsequently notes the one strength that centralized command has—centralized control over limited resources.[27] Van Creveld dressed this honor in an outfit of cost effectiveness—the allocation of monetary resources is more likely to be optimized by a centralized locus of command. If we stick with a decentralized model, he suggests (and somewhat vaguely) equalizing the distribution of monetary assets amongst the decentralized commanders. I will extend Van Creveld's comments to all resources since his comment opens questions regarding how to distribute resources in general. The quick answer by the decentralized supporter stipulates that forces will self-synchronize. Alberts and Hayes criticized centralized command for prizing "deconfliction over synergy."[28] Up to the present, the concept of command included the idea that a commander would deconflict and direct resources since he had the requisite authority to do so. Little work has been done in the area of resource deconfliction without a centralized commander. All that we have been told is that individuals will do it. I contend that individuals with understanding do not always have a motivation to self-synchronize. This is especially evident when there is a limited supply of resources or time. This observation will move us well beyond the decentralized model and provide an idea of when centralized command is desirable.

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[25] Yet, this is no small problem. There is no clear way to pin power to understanding. Approximating understanding by saying it should follow information is difficult—especially if everyone has access to the same information. If by "information," one means understanding, then this begs the question.

[26] Martin Van Creveld, *Command in War* (Cambridge: Harvard University Press, 1985), 269.

[27] Ibid., 271.

[28] *PTTE, 63-64.*

5) The locus of command should be located where a commitment to achieve the global maximum and where understanding is present

Perfect coordination yields the best global solution but not the best locally optimized solution. If this sounds familiar, it is likely because it is a central thesis of game theory. Rarely, if ever in the real world is their total common interest. To have total common interests, all subgroups and persons involved have to have all their subgroup's and their own personal interests in perfect accord with the common interest.[29] Career aspirations, self-preservation, and the method that best accomplishes the common interest in varying situations are all detractors from the common interest. When the global solution requires ultimate sacrifices from what may seem like relatively few, those few will often not work off that motivation to seek global optimality. I do not speak merely of sacrificing one's life for a greater cause. I have in mind the sacrificing fame, honor, and favorable performance reviews for insignificance, unremarkable performance reviews, passivity, and chiefly, differing opinions on how to best execute the common interest. Self-synchronization is at times antithetical to human nature. Game theory provides models where there is only partial common interest. It is easy to imagine these types of situations.

One historian recounts Patton's uncompromising desire for resources and advancing the troops. "As the campaign across France took shape, Patton and Montgomery frequently urged different approaches. Rivalry between the two intensified, and as logistics tightened they became competitors for supplies. When the Third Army was halted in its drive, a frustrated Patton began fighting for the right to continue his advance."[30] Why did Patton's Third Army run out of fuel? How does a decentralized command structure answer to limited resources. Resources are not released for the greater cause because individual services and even individuals only have partial common interest. In the event of urgent simultaneous calls for a resource, what model does decentralized command offer for allocating resources? How might it proceed? Without unlimited resources, self-synchronized resource allocation will tend toward vying for the spotlight for political attention with the best politician reaping the spoils. It will allocate resources based on rank or even an algorithm that doesn't have a genuine feel of the situation. In these situations, it seems necessary that a centralized commander step in. When there are more immanent targets than fire-power, more humvees than armor retrofitting material, or more starving children than food, each decision maker will lay first claim on the limited resources.

In his book Utopia, Thomas Moore writes, "that while other nations part with their gold and silver as unwillingly, those of Utopia would look on their giving in all they possess of those metals, but as the parting with a trifle, or as we would esteem the loss of a penny. They find pearls on their coast, and diamonds and with them they adorn their children, but when they grow to years, they of their own accord, without being bid by their parents, lay them aside." In Utopia, resources are not a problem. In Utopia, there is total common interest and no one's life is privileged.

This assessment is an outworking of commander's intent. In reality, decentralized command is logically antithetical to commander's intent. Commander's intent presupposes a centralized command. This centralized command can be looked to in order to resolve disputes.

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[29] Executing the total common interest also supposes that the common intent is perspicuously known to its fullest degree by each person *and* that the intent can be applied correctly in each situation.

[30] "George S. Patton," *The Simon and Schuster Encyclopedia of World War II* (New York: Simon and Schuster, 1978), 642.

Decentralized command presupposes that no such authority can be approached. Any intention that is available is generated by the decentralized commanders. Unless their intentions match up perfectly, then there will be disagreements on how to proceed. This final observation undermines the third of Power to the Edge's three tenets—individuals will be able to coordinate and synchronize without a centralized commander.

Summary

Martin Van Creveld wrote "To allow [information processing technology] to dictate the structure and functioning of command systems, as is sometimes done, is not merely to become the slave of technology but also to lose sight of what command is all about."[31] The human aspects of command continue to be the most difficult to overcome and the most indispensable components. After analyzing where C2 theory has been and is going, I have argued that the locus of command should be pushed to the edge only when the global maximization of desired effects is better approximated. This avoids statically placing power in any group's hands as a matter of doctrine and avoided the mistake of having power unquestionably follow information.[32]

[31] Ibid., 275.

[32] I am grateful to my friends Juan Carbonell, Jerry Dussault, Todd Humiston, Mike Wessing, and Steve Farr for providing feedback and helping me develop many of the lines of thought contained in this paper.